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Carp in a Can

Imagine ordering a carp-salad sandwich at your favorite deli. That scenario may be just around the proverbial corner, according to studies by ARS and University of Arkansas researchers. More than 60 percent of participants in consumer taste panels preferred the mild taste of canned bighead carp over tuna. They also said they'd pay at least as much for the product as for tuna. As prepared for this research, bighead carp is also healthful. Analyses show that it's lower in fat than white meat tuna packed in water. Plus, about 40 percent of the canned carp's fat are omega-3 acids, which can reduce the risk of heart disease and relieve the inflammation of rheumatoid arthritis and other inflammatory diseases. What's more, carp is loaded with calcium because it's loaded with bones—tiny bones much smaller than a salmon's.

The many bones are what have kept bighead carp out of U.S. fresh fish markets, except those frequented by Asian shoppers. However, canning softens the bones, making them edible and almost indetectable to the eye. Worldwide, this Chinese delicacy is the most eaten fish, and it's considered the Cadillac of fish in Asian countries. In the U.S., it is already swimming in many commercial catfish ponds, helping to control the growth of algae and other plankton. Bighead carp flourish on plankton, preferring it to fish food. So they don't compete with catfish—at least in the pond.

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Heart-Healthy Compound Found in Peanuts

Enjoying a glass of wine before dinner to help your heart? You might want to try a handful of peanuts, too. This may seem like a contradiction because of peanuts' high fat content. But recent research found that peanuts also contain a compound called resveratrol. That's the same compound behind red wine's apparent ability to offset the artery-damaging effects of a high-fat diet.

Red wine's resveratrol levels average approximately 160 micrograms per fluid ounce. By comparison, one ounce of peanuts—about a handful—contains an average of 73 micrograms of resveratrol, according to ARS peanut studies. And there are about 14 grams of fat in one ounce of shelled peanuts with skins.

A large epidemiological study done by researchers at Loma Linda University in southern California found that people who ate nuts five times a week cut their heart attack risk by 50 percent. In the Iowa Women's Health Study, which included 40,000 post-menopausal women, researchers also found a connection between nut consumption and reduced coronary disease risk. Peanuts made up a significant percentage of the nuts consumed in both studies. Together, the findings suggest that, in moderation, peanuts can be a heart-healthy food.

ARS researchers found that the type of peanut and the environment in which it is grown can affect resveratrol levels in the nuts. Peanuts are known to be a good source of vitamin E and folic acid.

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Vitamin E Boosts Immunity in Elders

An extra 200 milligrams of vitamin E daily may help reduce infections in older people, but bigger doses of the vitamin don't mean bigger benefits. In a recent ARS study, men and women over age 65 who took daily vitamin E supplements had improvements in the immune system's response to foreign antigens—substances that prompt the body to produce antibodies.

The immune system declines with aging, contributing to increased infections. Until now, few nutritional interventions have boosted older people's immune response. The 80 volunteers in the study took either 60, 200 or 800 mg of vitamin E—or a look-alike placebo—each day for 4-1/2 months. Then they were given a standard test, called DTH, that measures the body's reaction to seven antigens injected into the skin. The DTH test indicates how well immune-system cells called T cells "remember" antigens they have seen before and how to respond to them. Compared with the placebo group, the group getting 200 mg daily—equivalent to 200 International Units—had a 65

percent increase in DTH response. Those taking 800 mg had a 49 percent increase, the researchers reported in the *Journal of the American Medical Association* (vol. 277, pp. 1380-1386).

The 200-mg group also produced the most antibodies to three vaccines administered after the supplemental period. For example, their antibodies to hepatitis B virus were sixfold greater than those in the placebo group. The findings suggest that 200 mg is a threshold level, and that higher levels confer no extra benefit.

That vitamin E enhances the immune system is further supported by an animal study these researchers reported in the *Journal of Infectious Diseases* (vol. 176, pp. 273-276). Older mice receiving high doses of vitamin E suppressed influenza virus far better than those getting the recommended level of vitamin E. Until now, only food restriction has subdued this virus in animal studies. And that's not practical for people.

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Counting Calories More Precisely

Can you trust the number of calories per serving on the label of a frozen fruit pie or vegetable medley? A recent ARS study indicates that values listed for fiber-containing foods could be more accurate if food companies used an equation developed in 1991 by a British researcher. Because some calories in foods don't get digested and absorbed, food manufacturers estimate the available calories in each product. ARS researchers found that the 1991 Livesey equation is a better predictor of this so called "metabolizable energy" than some equations now sanctioned by the U.S. Food and Drug Administration. They also found that the amount of total dietary fiber can be used in the equations interchangeably with the amount of insoluble fiber, known chemically as NDF. Each produces essentially the same calorie value.

The researchers tested nine diets on 17 volunteers for two weeks at a time. They measured how much carbohydrate, fat, protein, fiber and energy (calories) the volunteers used from the diets—nine combinations of low, medium and high fat with low, medium and high fiber. Dieticians increased the fiber intake by adding breakfast cereal, carrot and celery sticks, tossed salads, canned and fresh fruits, cookies, nuts and sunflower seeds to the menu.

Overall, increasing the fiber intake decreased the digestion and absorption of both fat and protein, the researchers reported in the *Journal of Nutrition* (127, pp. 579-586). As a result, available calories decreased as fiber increased. Based on actual measurements, the researchers estimate that if U.S. men doubled their daily fiber intake from an average 18 grams to 36 grams—the highest amount used in this study—they would absorb about 130 fewer calories per day. For women, doubling fiber intake from 12 to 24 grams a day would reduce absorption by 90 calories.

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Spinach 'n Strawberries—An Antioxidant Recipe

Eating a half pound of strawberries or spinach can be just as effective as taking a large dose of vitamin C in helping the human body defuse oxygen radicals that can damage cells. That's the latest finding from ARS research into the antioxidant capacity of fruits and vegetables. Last year, the researchers found strawberries and spinach to be high in total antioxidant capacity among 40 common fruits and vegetables they tested, using a highly sensitive chemical assay they developed.

Next, they wanted to find out whether those protective compounds could be absorbed by the human body in sufficient amounts to boost the blood's antioxidant profile. They analyzed the blood of eight women in their 60s and 70s before and after eating five test meals. Each woman first ate a control meal with a low antioxidant content. Then, over the course of two months, the researchers added either a strawberry extract, a spinach extract, red wine or 1,250 milligrams of vitamin C to the control meal. The strawberry and spinach extracts were consumed as drinks having the equivalent of 8 to 10 ounces of the produce.

Simply eating the control meal increased the antioxidants circulating in the women's blood up to 10 percent. The strawberry and spinach extracts boosted the antioxidant capacity another 20 percent. That's as much protection as the women got from taking the vitamin C. Red wine was somewhat less effective, boosting antioxidant capacity by 15 percent above the control level. Some but not all of the antioxidant boost was due to vitamin C and uric acid—an antioxidant made by the body, the researchers found. They conclude that other antioxidants—probably polyphenols—are being absorbed from the fruits and vegetables.

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The Down Side of Calorie Cutting

Weight-loss diets can hinder natural killer cells—an important part of the immune system—even if the diets provide healthful meals. A new ARS study confirms earlier findings by other scientists about changes in killer cell activity in fasting or malnourished people. Eight healthy women, age 28 to 41, cut their calorie intake in half for 15 weeks. The researchers found about a 20 percent decrease in the activity of killer cells, which help protect the body against viruses and tumors. They measured this activity

with a standard laboratory test in which natural killer cells isolated from blood samples were mixed with target cells. Target cells successfully attacked by the killer cells released a tracer element—a special form of chromium—that the researchers could then measure.

Physicians, dietitians and other healthcare professionals could use the information to improve weight loss programs by minimizing unwanted effects on the immune system. Longer and more restrictive periods of dieting could further undermine the killer cells, scientists caution. An estimated 40 percent of American women and 25 percent of American men are trying to lose weight. Obesity increases risk of diabetes, cardiovascular disease, hypertension and other illnesses.

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Citrus Squeezed for Cancer Fighters

A new technique makes possible—for the first time—large-scale extraction of useful natural compounds known as limonoid glucosides that show promise as cancer-fighting agents. ARS researchers identified the chemicals nearly a decade ago in oranges and other citrus fruits. At that time, food-industry interest centered on their role in reducing bitterness of citrus juices.

ARS scientists helped develop the new manufacturing technique with Japanese researchers. The Japanese group has test-marketed a fruit juice beverage with added limonoid glucosides. The team has applied for patent protection for their method of extracting the glucosides from citrus juice or the thick, dark brown material called citrus molasses. Citrus molasses comes from peels and other citrus waste, while the molasses familiar to consumers is produced during the refinement of raw sugar from sugarcane or sugar beets.

In the new method, the citrus juice or citrus molasses passes through a device lined with material that collects up to 100 percent of the desired compounds. Washing out the material with a solvent such as alcohol yields a purified liquid full of limonoid glucosides.

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Dietary Choices Don't Reflect Knowledge

What we eat in America isn't necessarily what we *think* we should eat. That's the bottom line from ARS' most recent nationwide food consumption survey. Two-thirds of adults think it's very important to choose a diet with plenty of vegetables and fruits—as stated in one of the Dietary Guidelines for Americans. But their survey responses, collected in 1994-95, showed consumption of these foods has increased only slightly since the late 1970's. Fruit intake is slightly below the minimum two servings recommended in USDA's Food Guide Pyramid. Vegetable intake is only slightly above the minimum three servings. And, veggie consumption leans more to french fries than to the dark green and yellow vegetables associated with health benefits.

On the other hand, while grains form the base of the Food Pyramid, less than one-third of adults think eating plenty of breads, cereals, rice and pasta is very important. Yet, consumption of these foods has jumped more than 40 percent since the late 1970's.

Ninety percent of adults believe it's important to maintain a healthy weight. But 40 percent think they consume too many calories, and one-third are overweight. What's more, 28 percent of men and 44 percent of women report they rarely if ever exercise vigorously.

Sugar and salt/sodium consumption also doesn't follow beliefs. Eighty-five percent of adults agree with dietary guidelines that advise a diet moderate in sugars. But Americans daily consume an average 19 teaspoons of sugar that is added to their foods—by beverage and food processors or by consumers themselves. These 19 teaspoons account for 15 percent of our total calories for the population as a whole, and a considerably higher percent for adolescents.

As for sodium, men exceeded by two-thirds the recommended upper limit of 2,400 milligrams daily. That's from foods alone, not counting salt added at the table. Women's diets have less sodium than men's, but they still consume one-quarter more than the recommended limit from foods alone.

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A Nutritious Food for Peace

A new, high-quality food product made from grain blends will help meet the daily nutritional needs of hungry people in emergency and supplemental feeding programs overseas. Made from corn and soybeans, the precooked powdered food does not require further heating and is fortified with added vitamins and minerals to further increase its nutritional value. Adding tap water creates a porridge that is nutritious enough to serve as the only food source in refugee camps and other emergency feeding situations. Since no cooking is required, the need for firewood—a scarce resource in many refugee situations—is reduced.

The new, blended foods may contain different combinations of grains, legume products and vegetable oil, depending on cost. But they must meet nutrient standards developed by an ARS task force to reflect the latest thinking. The product must provide 20 percent high-quality protein, 12 percent vegetable oil, 60 percent carbohydrate, and eight percent moisture plus specified levels of vitamins and minerals. And it must be acceptable to those it is intended to feed. The improved food product is a joint effort among ARS and USDA's Farm Service Agency, the U.S. Agency for International Development (USAID), private voluntary

agencies and industry. It was developed for USAID's Food for Peace program.

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Zinc Helps Children Think

Peanuts, popcorn, whole-wheat crackers and other foods high in zinc could help some children learn and reason better. In an ARS-led study, daily zinc supplements helped Chinese schoolchildren with very low body zinc levels to score better in perception, memory, reasoning and psychomotor skills such as eye-hand coordination. An ARS psychologist spearheaded the study with Chinese scientists because of earlier conflicting reports. Changes in zinc intake had affected measures of cognition in three studies of adults, but failed to do so in two studies of adolescent boys and girls.

Findings of the new study with 372 Chinese school children--conducted in three poor, urban areas of China--support the adult studies and have important implications for countries where low zinc intakes are common. They could also apply to the 10 percent of U.S. grade-school-age girls and 6 percent of boys who get less than half the Recommended Dietary Allowance of zinc through their diets. The RDA for this age group is 10 milligrams daily.

The Chinese children, age 6 to 9 years, were divided into three groups. One group took a 20-milligram zinc supplement daily for 10 weeks. A second group took the zinc supplement plus a micronutrient supplement containing all essential vitamins and minerals, except for zinc and four other minerals known to interfere with its absorption. A control group got only the micronutrients to alleviate any other deficiency that could affect performance on the psychological tests.

Before and after the supplement period, each child took a series of computer-administered tasks developed by the ARS psychologist. The tasks measured attention, perception, memory, reasoning and motor and spatial skills necessary for successful school performance. The children who got the zinc supplement or zinc plus the micronutrients had the most improved performance, especially in perception, memory and reasoning skills.

In addition to peanuts, popcorn and whole wheat products, the most common source of zinc is red meat. Oysters are the richest source.

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Chromium—An Antioxidant, Too?

Chromium supplements—in two different formulations—lowered blood pressure in rats bred to spontaneously develop hypertension. The supplements, chromium picolinate and chromium nicotinate, also reduced the formation of damaging free radicals in the animals' tissues, indicating that chromium can act as an antioxidant. The findings confirm and expand on those of an earlier collaborative study between Georgetown University and ARS scientists.

In the earlier study, chromium nicotinate lowered blood pressure in the rats after researchers exaggerated hypertension by adding table sugar to their drinking water. In the latest study, the Georgetown University and ARS researchers tested four other chromium formulations and found that three—chloride, acetate and picolinate—also significantly lowered the rats' blood pressure.

This was not as surprising as one might expect. Earlier human studies have linked hypertension with diabetes and with insulin resistance—the inability of insulin to get glucose into cells. Chromium is essential for insulin to operate efficiently and has been shown to reduce diabetic symptoms and restore glucose tolerance in studies of humans and animals. Two of the chromium formulations, picolinate and nicotinate, reduced blood sugar. That's according to the animals' hemoglobin A_{1c} levels—the most sensitive measure of blood sugar.

What's more, both compounds reduced the formation of free radicals in the animals' livers, based on measurements of highly reactive free radicals. The nicotinate formulation was also protective in their kidneys. Free radicals form naturally in cells and are counteracted by antioxidants.

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